

Periscope.

a.—PHYSIOLOGY OF THE NERVOUS SYSTEM.

ASPHYXIA.—Dr. Alexander Harvey has pointed out some discrepancies in recent physiological statements about death by suffocation. The first of these discrepancies arises in relation to the state of the pulmonic capillaries at the moment of death. It is usually taught that in asphyxia the lungs are full of venous blood, whilst the pulmonic veins, left cavities of the heart, and the systemic arteries are empty of blood, whilst the pulmonic arteries, the right cavities of the heart, and systemic veins are full of blood. Dr. George Johnson maintains that the capillary vessels are quite empty or virtually quite empty, and the lungs anæmic and collapsed, the muscular arterioles playing the essential part. His theory is that the minute arteries of the body are furnished throughout with a delicate layer of muscular fibres laid circularly between the external and the internal lining coat, and that these muscular fibres are under the controlling influence of a system of nerves—the vaso-motor. When the access of air to the lungs is at once and completely excluded the blood is no longer arterialized, and continues to pass through the lungs, and is distributed to the system at large. When this blood meets the small systemic arteries, the vaso-motor nerves, finding that the blood is not of the right sort but venous, give intimation of the fact to the arterioles. These contract—exert their stop-cock action to such an extent as to impede the passage of blood through them.

Simultaneously with the contraction of the arterioles the systemic blood-pressure is augmented, with the result of causing the left cavities of the heart to dilate and become distended with blood, the distension being greater and more marked in the auricle because it is more distensible than the ventricle. The venous blood, although impeded in its course, returns to the right side of the heart, and, passing through it, reaches the small pulmonic arteries. Here a singular result follows. The pulmonic arterioles are accustomed to the presence of ordinary venous blood. They allow it to pass freely through the pulmonic arteries into the capillaries of the lungs. But after venous blood has once passed through the systemic capillaries and again reaches

them their vaso-motor nerves take alarm, advising the arterioles of impending danger, whereupon the arterioles exert their stop-cock action and contract, yet not as their systemic fellows do. Instead of merely impeding the upward flow of blood they gradually, yet rapidly, put a complete arrest to it. The passage of blood is blocked, and permanently blocked, none now gaining access into the pulmonic capillaries. Again, as before with the systemic, on the pulmonic arterioles thus contracting the pulmonic blood-pressure is raised, and the right cavities of the heart come to be dilated and distended with blood, the auricle standing out prominently as a tense round ball. It would thus appear that while venous blood is allowed to make one circuit as such through the lungs it is not allowed to make a second. That the pulmonic capillaries are so sensitive to the venous blood in question is remarkable.

The second of these discrepancies is as follows : in apnœa at the moment of death are the left cavities of the heart full or empty of blood? Dr. Fagge held that at the moment of death the left cavities of the heart are not only full of blood but gorged with it equally and alike with the right cavities, and that if in ordinary autopsies in the human subject the left auricle and ventricle are found comparatively empty whereas the right ones are distended, it is because the former unload themselves during the setting in of the rigor mortis. Dr. Johnson holds that at the moment of death the left cavities of the heart are empty. Dr. Harvey puts forth arguments to show that the left side of the heart is empty.—*Medical Times and Gazette*, 1883, Nos. 1744, 1745.

THE RELATIVE RAPIDITY OF THE TRANSMISSION OF VISUAL, AUDITIVE, AND TACTILE IMPRESSIONS.—This subject has been investigated by Dr. A. Bloch, in the laboratory of M. Marey. He divided his work into three distinct parts, each part comprising a comparison of two sensations. 1st. Hearing and touch; 2d. Hearing and vision; 3d. Vision and touch. In the first series of experiments the sound was produced by a plate of steel which struck at each turn of the cylinder against a pin fixed upon the instrument. The tactile irritation consisted in the rubbing of a finger by a thin piece of whalebone fastened to the cylinder. He found that tactile sensation transmitted from the finger of the hand took $\frac{3}{4}$ of a second longer than that transmitted by the auditory apparatus. Of the three physical sensations, that of vision is the most rapid; then comes that of sound, which is $\frac{1}{2}$ of a second longer than that of visual transmission; and that received by the hand—that is, tactile sensation—is $\frac{1}{3}$ of a second longer in transmission than that of vision.—*Gazette des hôpitaux*, No. 128, 1883.

THE MEDULLA OBLONGATA.—Dr. Coutin, of Bordeaux, reported the following symptoms, following a lesion of the medulla

oblongata by a knife. The lesion completely invaded the right posterior pyramid, and a little of the left posterior pyramid and the restiform bodies. The phenomena were as follows: An absolute insensibility on the side opposite the principal lesion—that is, the left side; motor paresis of the same side; and, finally, the abolition of the patellar reflex of this side. There was an escape of considerable cerebro-spinal fluid, which contained sugar but no albumen. The sensibility of the side of the face remained intact, except in the region of the chin. The temperature was 39° C. There was no modification of the respiration up to the moment of death.—*Gazette des hôpitaux*, No. 139, 1883.

THE INFLUENCE OF COFFEE UPON THE GASES OF THE BLOOD.—M. Conty has made researches upon this subject, and arrived at the conclusion that coffee diminishes the quantity of the gases in the blood, especially the amount of carbonic acid. The urea and the sugar in the urine increase.—*Gazette des hôpitaux*.—No. 139, 1883.

THE TIME OCCUPIED IN THE RESPIRATORY REFLEXES.—Dr. Max Joseph has made several experiments upon this subject. It results from the experiments of several observers that the degree of retardation which an irritation suffers in its course through a nerve-mass, shows the presence or absence of ganglionic apparatuses. When with an intact medulla oblongata, an artificial arrest of the respiration is produced by irritation of a sensory nerve, this is not caused by apnœa but by a reflex action. The question arises: Where does this reflex take place? Is it in the respiratory centres of the oblong medulla, or in the spinal centres, whose existence has been markedly called into prominence by Lagendorff? The time which is involved between the irritation of the cervical spinal cord, the roots of the phrenic, and a contraction of the diaphragm, he calls the “spinal latent period”; the time which ensues between the irritation of the medulla oblongata and respiration, the “bulbar latent period”; the time between the irritation of a spinal nerve and respiration, is the “reflex latent period,” first, with an intact medulla oblongata, and second, after an isolation of the spinal cord.

The “latent period of the vagus” is the time which ensues between an irritation of the vagus and the beginning of an inspiration. The animals used were young rabbits. When the spinal or reflex latency was measured, the medulla oblongata was divided at the level of the nib of the calamus from the spinal cord. To estimate the bulbar and vagus latency, a section was made above the *alæ cineræ* and the pneumogastrics divided. For purposes of irritation he used a constant current from six Daniell cells.

The spinal latency was found to be .0158”; the bulbar latency was .0427”; the reflex latency, after the removal of the medulla oblongata, was .0515”, whilst with intact medulla oblongata it was .046”.

He also varied the method of experimentation by applying a sponge wet with ammonia to the nose, so that an arrest of the respiration takes place, and then irritating the sciatic he found the reflex latency to be .0445". If the reflex latency was the same without the medulla oblongata being present, the place of the centre of respiration must be the same in both instances. It results from the above experiments that after isolation of the spinal cord as after high section of the medulla oblongata and by intact spinal cord and medulla, the reflex latency varies in regard to time. By the experiments with the isolated spinal cord the lesion might be supposed to increase the reflex time, but at no period was the time greater with the medulla oblongata attached than without it. Hence he concludes from these results that by irritation of a sensory nerve the sequential arrest of the respiration is not due to a centre in the medulla oblongata, but in the spinal cord. When he estimated the vagus latency he found it to be .1695", being three times as great as the reflex latency when the medulla oblongata was directly irritated, the latent period being .0427". From these facts he concludes that the irritation after the vagus is excited must travel through ganglionic centres, from cell to cell before it reaches the spinal respiration-centre.—*DuBois' Archiv*, 1883, sechstes Heft.

GOLTZ'S DOG AND FERRIER'S MONKEY.—At the International Medical Congress in 1881, Prof. Goltz exhibited a dog whose cortex lesions he believed were of such a nature and accompanied with such phenomena as to be destructive of the hypothesis of localization. Prof Ferrier also exhibited a monkey, which he believed proved the doctrine of localization.

The dog of Goltz exhibited the following phenomena: When he was let out he ran about here and there, wagging his tail. "The movements of the limbs are, as a rule, normal. The position of the eyes shows no deviation. When the eyes are moved, the eyes move in harmony. He has, however, lost the fixity of the eyes that a normal dog has. The animal can see, as he avoids objects in his path. He does not fear the sight of a whip. When a burning candle approaches his eye, he does not wink or move his head. He also hears, as he answers to calls, but does not run when ordered to. He smells. He can find meat; but cigar-smoke, which is disagreeable to dogs, he does not appear to mind. The sensibility of the skin is generally blunted, but there is no doubt but that he has sensibility everywhere. The animal possesses all his senses, but he does not understand impressions as an uninjured animal." He infers from this experiment and others:

1. That the cerebral cortex is the organ of the mind; that the removal of large pieces of each half of the cortex diminishes intelligence.
2. That it is not possible through destruction of a section of the cortex to cause paralysis of the muscle.

3. That it is also impossible by a destructive lesion of the cortex to cause a permanent loss of activity of the senses. The animal has all his senses. After the removal of large pieces of the cortex there ensues weakness of the perceptive faculties. The dog of Goltz was killed and examined by Drs. Langley and Klein. Their report is as follows :

The parts of the right brain have been reported on by Dr. J. W. Langley.

The parts of cortex injured were the suborbital lobe, the posterior lateral part of the prorean convolution ; in the fourth convolution, the dorsal surface of the anterior limb of the sigmoid gyrus except a small part of the mesial and of the lateral anterior regions, the posterior limb of the sigmoid gyrus except part of the mesial surface in front of the ansate fissure (possibly nearly the whole), the posterior third of the ento-lateral convolution, the posterior part of the supra-splenic convolution starting a little behind the posterior third of the ento-lateral fissure, the post-splenic convolution, the dorsal part of the posterior third of the splenic convolution ; of the third convolution, the coronal except a small piece at its anterior end, the ecto-lateral except a small mesial strip two to three millimetres wide from the ansate to the posterior third of the ento-lateral fissure ; the posterior supra-sylvian of the second convolution, probably the whole of the first convolution, the whole of the anterior composite convolution, a dorsal strip from the coronal to the anterior ecto-sylvian fissure, of the posterior composite convolution nearly all the posterior region, of the lateral region probably a dorsal strip. For the most part, the limits of the lesion coincide with the limits of complete removal of gray substance.

The left side of the brain of Goltz's dog was reported upon by Dr. Klein. The outline of the injured cortex starts a little behind the crucial sulcus, passes backward across the anterior end of what appears to be the ansate fissure, intersects the lateral fissure, and under a very oblique angle crosses the posterior end of the ento-lateral fissure, and having reached the mesial end of the posterior margin of the hemisphere curves round the latter. It then takes a forward course, crossing the ecto-lateral and the posterior supra-sylvian fissure. It then runs, still keeping a forward direction, across the posterior ecto-sylvian fissure, and just touches the dorsal end of the sylvian fissure. Crossing then the anterior ecto-sylvian fissure, it turns in an oblique direction mesially across the anterior supra-sylvian and the coronal fissure, and finally joins the place of starting. Thus the following convolutions appear involved in the injury : the middle part of the posterior sigmoid gyrus of the fourth or superior convolutions ; it comprises the greater part of the ento-lateral, the great portion of the posterior part of the post-splenic ; of the third or middle convolution it comprises the whole of the ecto-lateral and almost the whole of the posterior supra-sylvian and the posterior part of the coronal ; of the second or inferior convolution, it involves the

mesial portion of the posterior ecto-sylvian, the whole of the median ecto-sylvian, and a good bit of the anterior ecto-sylvian; of the first or sylvian convolution, it involves a small mesial portion of both the anterior and posterior sylvian. In addition to these convolutions, as it appears from vertical sections, the injury comprises part of the supra-splenic as well as the dorsal part of the posterior composite convolution.

Dr. Ferrier, at the same Congress, exhibited a monkey who had the motor zone of the left hemisphere destroyed seven months previously. There ensued complete motor hemiplegia of the right side. There was at the time no volitional motion of the right arm and leg. The animal in other respects is quite well; tactile sensibility is good. It had exaggerated tendon reflexes and diminished superficial reflexes. The right forearm is generally kept flexed, the thumb bent on the palm, and the fingers semi-flexed. The animal took pieces of food with the left hand. The brain of the monkey was given to Prof. Schäfer to examine and report upon. He found that the greater part of the two central convolutions and the adjoining parts of the frontal and parietal lobes on the left side of the brain had been removed. Underneath the lesion thus produced there had become formed by secondary processes in the medullary centre an excavation nearly conterminous with the superficial lesion and not involving the basal ganglia. The pyramidal tract connected with the left side of the brain has undergone the Wallerian degeneration throughout its whole extent. There existed an unexplained tract of degeneration in the left lateral column of the cervical cord.

The reporters, Drs. Klein, Langley, and Schäfer, make no comments upon these facts.—*Foster's Journal of Physiology*, vol. iv., Nos. 4 and 5.

THE ACTION OF HIGH ATMOSPHERIC PRESSURES.—Dr. E. De Cyon has recently studied this subject. The first series of experiments was made upon rabbits in a chamber whose pressure did not exceed two atmospheres. A large bag of oxygen was in communication with the trachea of the animal. A registering apparatus and a mercurial manometer were inside the apparatus, as was the observer.

The increase of pressure was made slowly, as was the decrease of it. In the first experiments, made with the compression of two atmospheres of ordinary air to modify the vaso-motor system in a manner to allow any conclusion as to the increased oxygenation of the blood, the mercurial manometer did not show any change in the vascular system under the two atmospheres, from normal. Direct inspection of the animal showed that as the pressure increased there was a narrowing of the capillaries visible to the eye, the skin and mucous membranes became pale, the ear became exsanguinated. At first sight this retirement of the blood from the periphery to the cavities of the body seemed to be due to variations in the nervo-vascular system. The question then arose

how to harmonize such a variation in the nervo-vascular system with the constancy of the arterial pressure. It was found that this narrowing of the vascular system was only peripheral, and due to mechanical causes.

The vessels of the cavities of the body compensate for the peripheral narrowing by a slight dilatation, and thus preserve the equilibrium. Compensations of this nature are very frequent in the vascular system. This experience suggests why there are extravasations of blood in the bones of the cranium, the envelopes of the brain, and perhaps in the brain itself. These extravasations are due to special conditions of the circulation in the cranium itself; the equilibrium of blood-pressure is not able to be promptly established so as to prevent rupture of the vessels, where high barometric pressures are used. These effusions explain the convulsions and paralysis, which have been asserted by M. Bert to be due to changes in the gases of the blood. When with two atmospheres oxygen is substituted for the ordinary air breathed by the rabbit, then only does the mercurial manometer indicate changes in the arterial tension, with changes of cardiac rhythm. The blood-pressure falls to fifty millimetres, the beats of the heart become more frequent, respiration is slowed. But the arterial tension returns to 100 millimetres. To explain these phenomena it is necessary to assume pressure on the peripheral vessels of the body. As to influence of the high pressure on the heart, the diminution of the tension of CO_2 enfeebles the moderating nerves, whilst the increased tension of oxygen excites the accelerators, hence the heart is accelerated.

He also found that with a rabbit breathing oxygen under a pressure of two atmospheres, irritation of a sensory nerve caused a fall instead of a rise in pressure. He then used dogs breathing ordinary air with the artery communicating with a mercurial manometer outside of the apparatus. The highest pressure used was three atmospheres.

The arterial tension at one atmosphere, commenced to fall till the pressure was two atmospheres, when it again mounted to about normal. At three atmospheres the pressure is diminished one half. The cardiac pulsations are less constant in their variations; they slowly increase. The respirations at two atmospheres diminish a little; beyond two, on the contrary, they become very few. He then tried the animal breathing oxygen, and found that the general character of the modifications in the circulation were about the same as when ordinary air was used, only they are more marked. The diminution of pressure is ten millimetres, as it is after section below the medulla oblongata; the frequency of the heart is nearly double, and the respiratory movements are few. The explanation of these changes does not present any difficulty. The tension of the carbonic acid, the principal excitant of the vasomotor and respiratory centre, is diminished, the arterial tension necessarily falls, and the respiration is arrested. The cardiac

frequency is increased for the same reason. Hence, when at a pressure of $2\frac{1}{2}$ to $2\frac{3}{4}$ atmospheres, the animal really breathes oxygen (and not a mixture of carbonic acid, oxygen, and nitrogen, as in the experiments of M. Bert), circulation becomes nearly impossible, and respiration nearly ceases, and this happens for reasons uniquely dependent on the oxygen and carbonic acid, upon the nervous centres presiding over these two vital functions. Of the toxic action of oxygen as held by M. Bert, there is no trace.—Supplement-Band, *Festschrift für E. Du Bois-Reymond*, October, 1883,

PSEUDO-MOTOR ACTION OF THE NERVES.—Prof. Heidenhain has made a series of experiments upon this subject. Over twenty years ago Philippeaux and Vulpian found in dogs that when all the roots of the hypoglossal were torn out of the skull, and after a few months, the usual motorial, inactive, lingual branch of the fifth pair by mechanical irritation caused movements in the paralyzed half of the tongue. Vulpian found that the nerve involved here did not come from the fifth pair, but from the chorda tympani.

Prof. Heidenhain's observations were made upon dogs whose left hypoglossus had been previously cut. The animal was placed upon his back, so that the under surface of the tongue was exposed to a large extent. The lingual nerve of the paralyzed side and the hypoglossal of the sound side, and very often the lingual of that side, were exposed in such a manner that, after previous division, irritation of its peripheral end could be made without danger of spreading of the current.

The tongue on the paralyzed side showed the fibrillary contractions; the primitive muscular bundles appear, independently of each other, in continuous movement like those seen in the cilia. His observations began with the fourth day after the division of the hypoglossus, and the movements increased to the end of the third week. After this they became weaker, and did not disappear till the sixth week. He saw in some cases, after irritation of the about lingual nerve, a small part of the tongue, through its longitudinal fibres, contracting; but usually there was no result. He considered this exceptional muscular contraction to be due to fibres coming into the lingual from the hypoglossal. When he irritated the lingual three weeks after a section of the hypoglossus, the muscular glimmer increased, or, if not present, the irritation caused it to appear. If the irritation is increased there is an increased rapidity of the muscular glimmer and a superficial bending of the left side of the tongue. The contraction caused by lingual irritation is different from that caused by hypoglossal irritation. It begins slowly at the base, and very gradually with increasing intensity reaches the tip of the tongue. These phenomena were accompanied by vaso-dilatation. Heidenhain also believes that the motor action of the lingual is due to the chorda tympani. The reaction-time of the hypoglossus is .015-.020 of a

second ; the reaction-time of the lingual is .08, which is the quickest time he noted (usually it is considerable more). The strength of the contraction caused by irritation of the hypoglossus is at least six times as strong as that caused by irritation of the lingual. Chemical irritation of the lingual had hardly any effect. During the excitation by morphia, the muscular glimmer increases. The muscular waves can be called out by reflex action. With nicotin, in the first period there is considerable vascularity of the tongue and an increase of the fibrillary contractions ; in the second period they disappear, the tongue is less vascular ; in the third period irritation of lingual causes vaso-dilation but no muscular contraction ; in the fourth period lingual irritation causes muscular contraction as well as vaso-dilatation. If urari is injected till the hypoglossus has lost its action, then lingual irritation is without effect, but the spontaneous fibrillar contractions continue. Urari also prevents the primary irritation of nicotin on the tongue. In the normal state lingual irritation is without action, but after complete degeneration of the hypoglossus the nerve commences to act ; the muscle is not normal. The paralysis by nicotin and that of the chorda tympani go together, whilst urari prevents the irritation of nicotin and lingual irritation. The acceleration of the current of blood through the chorda tympani is not the immediate cause of the excitation of the muscle. The chorda, after separation and division of the hypoglossus, does not play the rôle of a motor nerve of the tongue, in the usual sense of the word, for the fibres are not in direct connection with the muscles of the tongue. The contraction caused by irritation of the chorda resembles that caused by irritation of a motor nerve going to an unstriated muscle. He is not able to give any satisfactory explanation of these facts.—Supplement-Band, *DuBois' Archiv*, 1883.

THE INFLUENCE OF THE FREQUENCY OF THE IRRITATIONS UPON THE GENERATION OF MUSCULAR FORCE.—This subject has been investigated by Prof. J. Bernstein.

He arrived at the conclusion, from numerous experiments, that at least up to fifty irritations in a second, the muscle-force evolved increases.—*DuBois' Archiv*, 1883.

RESPIRATORY INNERVATION.—Prof. Fredericq, of Liège, has studied this subject. He used rabbits and laid bare the medulla oblongata from behind, making an incision through the occipito-atloid membrane. By the application of small pieces of ice on the medulla the respiration becomes slower.

If the ice is removed and heat radiated to the oblong medulla the respirations increase. The rapidity of results after the application of heat or cold excludes the idea of the respiratory centre being in the spinal cord. If he cooled the medulla oblongata, and irritated the central end of the pneumogastric, the centres of inspiration are suppressed, and the fibres going to the centres of

expiration are in activity. The centres of inspiration are more sensitive to the cold than the centres of expiration.

Chloral has the effect of suppressing the action of the inspiratory fibres of the vagi, or rather of depressing the excitability of the centres in which they end. He also made experiments upon the effect of trigeminal irritation, by plunging the nose of a duck in water, a cannula being in the trachea. He found that respiration was arrested for a long time. The first movement that followed the arrest of respiration was not an inspiration, as is the case with the rabbit, but an active expiration which is followed by an inspiration. He believes this trigeminal sensitiveness to be a protecting agent to the nasal orifices against water.—*DuBois' Archiv*, 1883.

THE GASEOUS CHANGES IN FEVER.—Herr Lilienfeld has made with rabbits a series of experiments upon this point. His conclusions are as follows :

1. The formation of carbonic acid in fever is increased.
2. The amount of oxygen used is increased.
3. By the increase of both oxygen and carbonic acid in fever the respiratory quotient suffers no change.
4. The increase of gaseous changes is not a result of heightened temperature, but rather the cause. There must also simultaneously be a change in the regulation of the heat-dissipation, for it is well known that in healthy animals a large increase of the process of heat-production takes place, yet the temperature of the animal remains the same.
5. The regulation of the temperature of the body in fever continues. He arrives at the conclusion that in fever there is an increased innervation of the muscles, an increase of the irritations normally sent to the muscles through the nerves. He thinks that it is difficult to understand how new ferments in the blood could preserve the unchanged relation of the oxygen to the carbonic acid.

What the cause is of the increased innervation, the exaggerated muscular tonus, remains undecided.—*Pflüger's Archiv*, Band 32, Heft. 4, 5, and 6.

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b.—GENERAL PATHOLOGY OF THE NERVOUS SYSTEM.

Dr. M. Allen Starr, in an article entitled "THE VISUAL AREAS OF THE BRAIN, DETERMINED BY A STUDY OF HEMIANOPSIA" (*The American Journal of Medical Sciences*, Jan., 1884), publishes a collection of thirty-two cases, with carefully recorded autopsies, which confirm Munk's conclusions derived from seven years' experimentation on animals. Munk gives as a final statement of his work the following conclusions :

1. "Occipital lobes of the brain are necessary for the perception of visual impressions."